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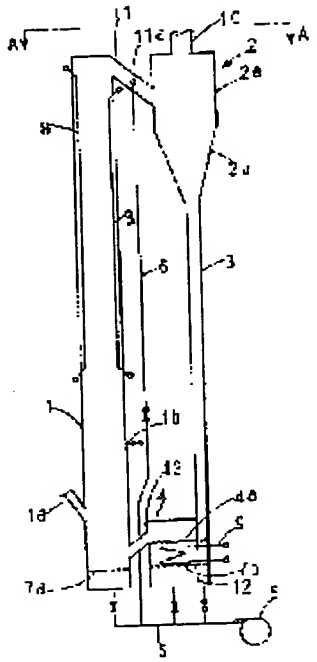
(54) RDF FIRED CIRCULATION FLUIDIZED BED FURNACE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a circulation fluidized bed furnace suitable for firing rigidified dirt fuel (RDF).
SOLUTION: The RDF fired circulation fluidized bed furnace comprises a swirl combustion chamber 2 comprising a tubular riser section 1 provided with a gas diffuser 7a on the bottom, a tubular section 2a, and a reverse truncated conical hopper section 2b coupled to the lower part thereof wherein a connecting pipe 11 is connected from the top of the riser section 1 to the tubular section 2a in the tangential direction a return pipe 3 is connected to the lower end of the hopper section 2b and a gas discharge pipe 10 is connected to the center of the upper surface, and an outer heat exchanger 4 comprising a gas diffuser 7b provided on the bottom and an inner overheat steam pipe 9 and disposed continuously to the return pipe 3 while being connected with an overflow pipe 12 for returning the overflowing fluid medium back to the riser section wherein the ratio of gas storing time in the riser section 1 to gas storing time in the swirl combustion chamber 2 is set in the range of 1.4-2.2.



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1. Field of the Invention

The present invention relates to a circulative fluid layer furnace which is good to combust a refuse derived fuel (hereafter, referred to as RDF) and collect an energy.

2. Description of the Related Art

In recent years, a larger scale of a refuse combustion facility has been requested as a dioxin measure. In association with a wider territory of refuse collection, it is desired to change the refuses collected for each city, town and village into RDF, carry it into a large scale of a refuse combustion facility of a 24-hour run, and combust it, and then carry out an electric generation, a warm water supply and the like.

[0003]

The RDF is formed by mixing a slight amount of limestone with combustible refuse, such as dried raw refuse, paper, plastic and the like, compressing them, and making into a mass of a size of, for example, 100 mm ϕ $\times$ 50 mm L. A stoker type incineration furnace or a bubbling type fluid layer furnace is used in order to combust the RDF.

[0004]

The stoker type incineration furnace has a problem that it is necessary to make a scale of

an apparatus larger since a thermal load in the stoker can not be made heavier and to install a large facility outside the furnace for the sake of de-nitration. The bubbling type fluid layer furnace (Fig. 3 shows its operational principle) has the following merits. That is, since a heat transfer pipe is placed inside the fluid layer and a heat transfer efficiency is high, a heat transfer plane may be narrow. Since a furnace bed load can be set to be heavy, its shape may be small. The usage of an in-furnace de-nitration does not require an exhaust gas de-sulfurizer. A low temperature combustion causes a thermal NOx generation to be small. A two-stage combustion enables the reduction in NOx and the removal of the dioxin. However, in the RDF combustion, there is a case of an occurrence of corrosive gas, such as hydrogen chloride gas HCl and the like, which results in a problem that the heat transfer pipe placed inside the fluid layer has an extremely short life because of the synergistic action of the mechanical abrasion caused by a fluid medium (silica sand and the like) and the chemical corrosion caused by the above-mentioned corrosive gas.

[0005]

On the other hand, the circulative fluid layer furnace (Fig. 4 shows its operational principle) has the following features. That is, it can attain a high combustion efficiency through a re-circulation of dispersed particles. Since a furnace bed load can be made heavier, the furnace can be miniaturized. The perfect circulation of the dispersed particles enables a limestone usage rate to be higher, and provides an excellent de-sulfurization performance. However, when the circulative fluid layer furnace designed for a coal (its fuel ratio of about 1.6) having a high fuel ratio (fixed carbon/volatile matter) is used to combust the RDF (its fuel ratio of about 0.15) having a low fuel ratio, various problems are brought about. [0006]

That is, in the RDF combustion in which a volatile component is greater than that of the coal, it takes a long time to perfectly combust the volatile component inside a riser portion. Then, unburned gas, such as CO and the like, which is generated inside the riser portion is easily exhausted from a system through a cyclone. When a massive coal of about 10 mm or less is combusted inside the riser portion, in order to circulate the fluid medium, if it is

assumed to be driven at a gas velocity of 5 to 6 m/s and a gas stay time is assumed to be about 4 seconds, the riser needs a height of 20 to 25 m. Thus, a building cost of a building and the like is made expensive. However, the fuel of the low fuel ratio, such as the RDF, does not require such a high riser portion.

[0007]

The present invention is proposed in view of the above mentioned problems in the conventional technique. Therefore, an object of the present invention is to provide an RDF combusting circulative fluid layer furnace, which can protect unburned gas, such as CO and the like, and dioxin from being exhausted from a room and also reduce a height of a riser portion by dividing a combustion of volatile matters of RDF into a two-stage combustion in a riser portion and a rotary combustion room and then combusting them.

Summary of the Invention

In order to attain the above-mentioned object, the RDF combusting circulative fluid layer furnace of the present invention is the RDF combusting circulative fluid layer furnace provided with:

a rotary combustion room including a

cylindrical tall riser portion having a dispersion plate at a bottom, a cylinder and a reversely conical hopper linked adjacently to a lower portion of the cylinder, wherein a linkage pipe is linked to a side of the cylinder from a top of the riser portion in a tangential direction, a return pipe is linked to a lower end of the hopper, and a gas exhaust pipe is linked to a center of an upper plane of the cylinder; and

an external heat exchanger which is linked to a lower end of the return pipe and has a dispersion plate at a bottom and also has a super-heating vapor pipe therein and to which an overflow pipe for returning an overflowing fluid medium to the riser portion is linked,

wherein a ratio of a gas stay time inside the riser portion to a gas stay time inside the rotary combustion room is 1.4 to 2.2

[0009]

The action of the present invention will be described below. A part of the combustion for the volatile matter occurring in the riser portion at the time of the RDF combustion is designed to be shared in the rotary combustion room. Inside the rotary combustion room, the rotary flow enables the excellent mixture of the air and the volatile matter. Thus, the volatile

matter is perfectly combusted, the unburned CO gas and the like and the dioxin are never exhausted from the room, and the height of the riser portion can be made lower. Also, since fixed carbon component is little in the RDF, char that seems to occur in the coal combustion is never combusted inside the external heat exchanger. Hence, inside the external heat exchanger, only the fluid medium forms the fluid layer, and the corrosive gas, such as HCl and the like, which may be generated at the time of the RDF combustion, is never generated in the external heat exchanger. The corrosive problem of the super-heating vapor pipe placed inside the external heat exchanger is not brought about. According to an experiment, a ratio of a gas stay time inside the riser portion to a gas stay time inside the rotary combustion room is desired to be 1.4 or 2.2. By the way, in the coal combusting circulative fluid layer furnace, this ratio is 3.8 or 5.0

Brief Description of the Drawings

Fig. 1 is a side section view of an RDF combusting circulative fluid layer furnace of the present invention;

Fig. 2 is an A-A arrow indication view of Fig. 1;

Fig. 3 is a view showing an operational principle of a conventional bubbling type fluid layer furnace; and

Fig. 4 is a view showing an operational principle of a conventional coal combusting circulative fluid layer furnace.

Description of the Preferred Embodiment

An embodiment of the present invention will be described below with reference to the attached drawings. Fig. 1 is a sectional view of an RDF combusting circulative fluid layer furnace of the present invention, and Fig. 2 is an A-A arrow indication view of Fig. 1. In Figs. 1, 2, 1 denotes a riser portion, which is tall cylindrical in shape. There is a dispersion plate 7a at a bottom of the riser portion. Below the dispersion plate 7a, air for combustion is supplied from a supply fan 5 through an air pipe 6. An RDF supply port 1a is installed on a lower side of the riser portion 1. A heat transfer pipe 8 for heating vapor is placed on a wall surface of the riser portion 1. 1b denotes a second air supply port installed on the side of the riser portion 1 to which the air pipe 6 is linked. One end of a linkage pipe 11 is linked to a top of the riser portion 1. A third air supply port 11a is installed in the

course of the linkage pipe 11.

[0011]

2 denotes a rotary combustion portion, an upper portion thereof is a cylinder 2a, and a lower portion thereof is a reversely conical hopper 2b. The other end of the linkage pipe 11 is linked off to a downward direction of a side of the cylinder 2a and in a linkage direction. A return pipe 3 is linked to a lower end of the hopper 2b. A gas exhaust pipe 10 is linked to a top plane of the cylinder 2a.

[0012]

4 denotes an external heat exchanger placed adjacently to a lower end of the return pipe 3. A dispersion plate 7b is placed on a bottom of the external heat exchanger 4. A lower portion of the dispersion plate 7b is divided into two rooms by a dividing plate 12. The air supply pipe 6 is linked to the respective rooms so that the pressures inside the rooms can be separately adjusted. Inside the external heat exchanger 4, a bubbling type fluid layer 4a is formed by the air sent through the dispersion plate 7b. A super-heating vapor pipe 9 is placed inside the fluid layer 4a. The fluid medium overflowing the fluid layer 4a is returned back to the riser portion 1 through an

overflow pipe 13.

[0013]

The operation of this embodiment will be described below. The RDF is supplied into the riser portion 1 from the RDF supply port 1a. In the riser portion 1, the air passed through the dispersion plate 7a causes the combustion gas to flow from a downward direction to an upward direction at a velocity of 5 to 6 m/s. In association with the flow, the fluid medium also flows from the downward direction to the upward direction. The RDF is combusted while the volatile matter is dispersed, inside the riser portion 1. The volatile matter dispersed from the RDF is mixed with the second air supplied from the side of the riser portion 1, and it is combusted. The stay time of the combustion gas inside the riser portion 1 is desired to be 2.8 to 3.3 seconds. The combustion gas and the fluid medium flow from the top of the riser portion 1 through the linkage pipe 11 into the rotary combustion room 2 in a tangential direction. The combustion gas is mixed with the third air supplied from the middle of the linkage pipe 11 and perfectly combusted inside the rotary combustion room 2. Inside the rotary combustion room 2, the rotary flow

enables the excellent mixture of the air and the unburned gas. Thus, even if the remaining oxygen amount in the exhaust gas at the outlet of the rotary combustion room 2 is 5 to 6 %, the perfect combustion can be attained. The CO gas, the dioxin and the like are never exhausted from the room. The stay time of the combustion gas inside the rotary combustion room 2 is desired to be 1.5 to 2 seconds. Hence, the ratio between the gas stay time inside the riser portion 1 and the gas stay time inside the rotary combustion room 2 is desired to be 1.4 to 2.2.

[0014]

The fluid medium of a high temperature separated inside the rotary combustion room 2 is dropped into the external heat exchanger 4 through the return pipe 3. Inside the external heat exchanger 4, the bubbling type fluid layer 4a is formed on the dispersion plate 7b, and the super-heating vapor pipe 9 is placed within the fluid layer 4a. Only the fluid medium exists inside the fluid layer 4a, and there is no occurrence of the corrosive gas. Thus, a life of the super-heating vapor pipe 9 is long. The fluid medium overflowing the external heat exchanger 4 is returned through the overflow

pipe 13 into the riser portion 1.

[0015]

The present invention is not limited to the above-mentioned embodiment. Various modifications can be made thereto without departing from the scope of the present invention.

Advantageous Effects of the Invention

As mentioned above, the RDF combusting circulative fluid layer furnace of the present invention has the excellent effects of the reduction in the building cost of the building and the like and the decrease in the environmental pollution, since from the viewpoint that the fuel ratio of the RDF is extremely low as compared with the coal, the part of the combustion of the volatile matter in the riser portion is shared in the rotary combustion room, it is possible to make the height of the riser portion lower and also possible to reduce the exhaust amounts of the unburned CO and the dioxin.

What is claimed is:

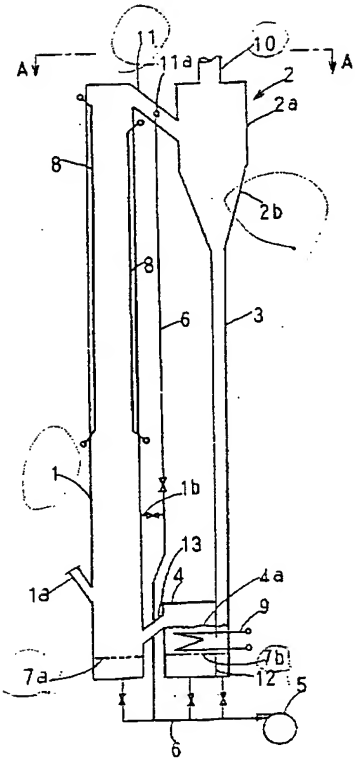
1. An RDF combusting circulative fluid layer furnace provided with:

a rotary combustion room including a cylindrical tall riser portion having a dispersion plate at a bottom, a cylinder and a reversely conical hopper linked adjacently to a lower portion of said cylinder, wherein a linkage pipe is linked to a side of said cylinder from a top of said riser portion in a tangential direction, a return pipe is linked to a lower end of said hopper, and a gas exhaust pipe is linked to a center of an upper plane of said cylinder; and

an external heat exchanger which is linked to a lower end of said return pipe and has a dispersion plate at a bottom and also has a super-heating vapor pipe therein and to which an overflow pipe for returning an overflowing fluid medium to said riser portion is linked,

wherein a ratio of a gas stay time inside said riser portion to a gas stay time inside said rotary combustion room is 1.4 to 2.2.

【図１】



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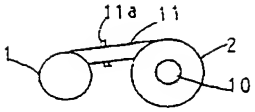

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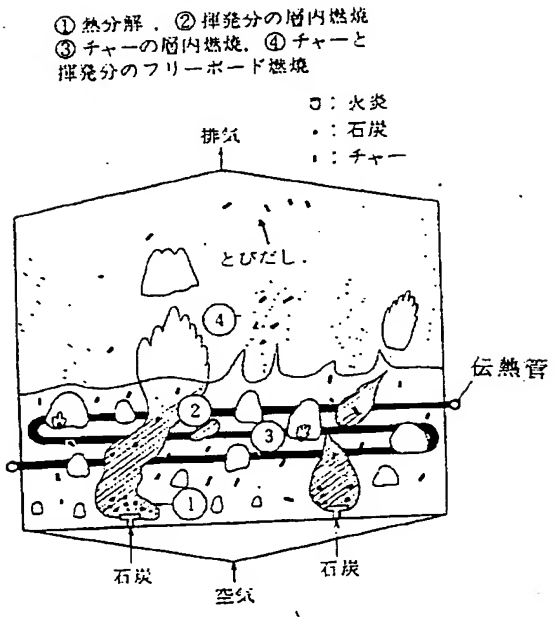

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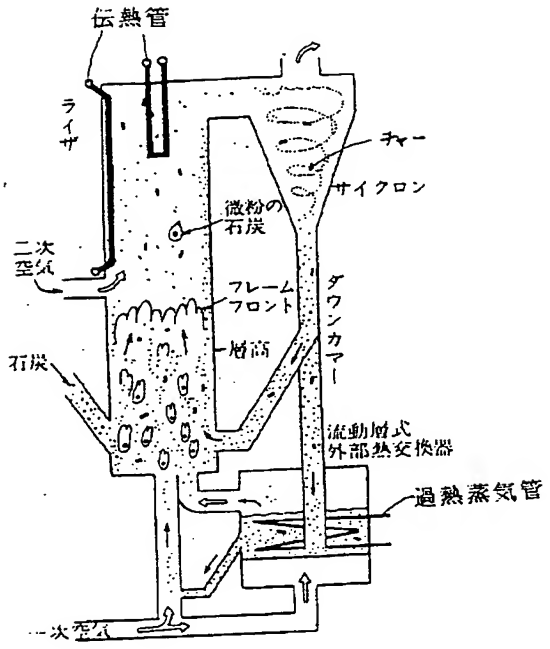

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